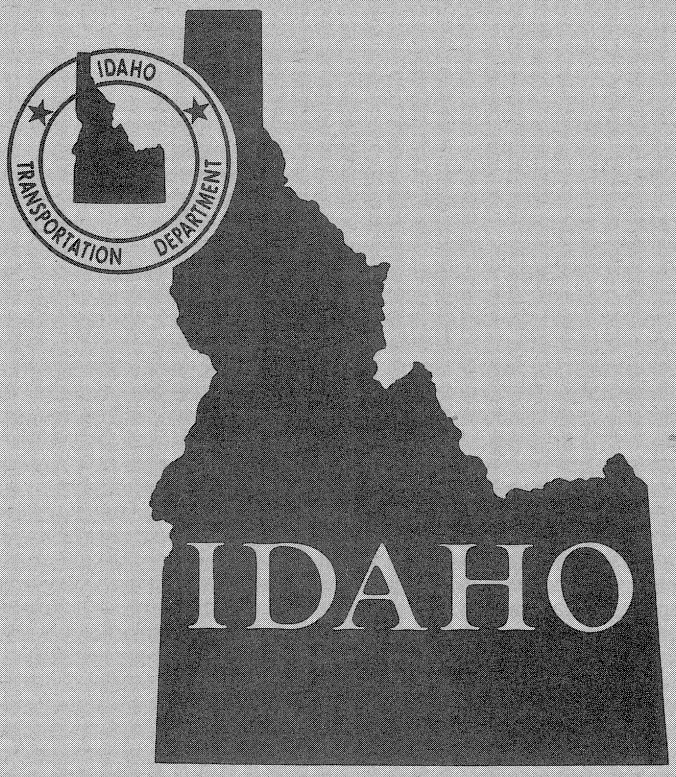
Research file

TRANSPORTATION DEPARTMENT
DIVISION OF HIGHWAYS

ALKALI REACTIVITY OF CONCRETE
AGGREGATES USED IN IDAHO

AUGUST 1975

RESEARCH PROJECT NO. 6
SUMMARY REPORT



MATERIALS and RESEARCH SECTION

ALKALI REACTIVITY OF CONCRETE AGGREGATES USED IN IDAHO

AUGUST 1975

RESEARCH PROJECT NO. 6
SUMMARY REPORT

By

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ABSTRACT

This report summarizes the history of a long-standing Idaho research project for which no previous formal report has been published.

No laboratory work has been done since the early 1950's. The report recommends termination of the project without publication of the data. This recommendation is based on the assertion that the alkali-aggregate reaction problem was overcome during the 1950's and is no longer a significant topic for research.

BACKGROUND

In the late 1930's a number of concrete highway structures in Idaho and other states were observed to be deteriorating prematurely. The cause was eventually traced to a chemical reaction between certain silica aggregates and alkali components of cement.

Within the Department an extensive program of field documentation and laboratory testing was undertaken to determine the extent to which various aggregate-cement combinations suffered from the alkali-aggregate reaction. At the same time, the problem was being studied by various other states and by national agencies such as the Bureau of Public Roads and Bureau of Reclamation.

By the early 1950's the causes and cures of the alkali-aggregate reaction were reasonably well understood. Preventive measures were put into effect, and the problem was brought under control. At about that time, Idaho's laboratory work on the subject was halted; but no formal report was ever published.

DISCUSSION

From 1939 through 1944 the deterioration of a number of Idaho highway structures due to alkali-aggregate reaction was documented by taking photographs periodically. Then, in the early 1940's, a program of laboratory testing was begun to measure the concrete expansion associated with the reaction. These expansion tests were of two types. The simplest test consisted of filling a glass canning jar with mortar, sealing the jar, then curing at 100°F. Cement-aggregate combinations having significant alkali reaction would crack the jar within very few weeks. The second type of expansion test measured the linear expansion of 1" x 1" x 10" mortar bars over a period of several years. The results of one such test series appear as Appendix A of this report. The lower three curves indicate acceptable combinations of cement and aggregate. Detailed mineralogical classification of several aggregate sources was done as part of the test program to identify the specific minerals common to reactive aggregates.

During the time of the Idaho testing, other states and government agencies were also intensively studying the alkali-aggregate reaction. By the early 1950's it had been determined that the use of low-alkali cement would eliminate or greatly reduce the expansion associated with most of the reactive aggregates. Idaho's test results generally supported the findings reported by others working on the problem, but the Idaho results were never published.

Idaho has specified cement having less than 0.6% total alkali since about 1950, and this has effectively solved the problem. Very little research on the alkali-aggregate reaction has been needed or undertaken since the mid 1950's. Publication of Idaho's test results now would serve only a minor historical function since the problem is not of current concern. Therefore the complete results have been omitted from this report.

CONCLUSIONS

Alkali-aggregate reaction is not currently a significant research topic because the problem can be overcome simply and effectively by using recommendations from previous research completed in the 1950's.

Publication of Idaho's alkali-aggregate reaction test findings dating from the 1940's would be of very limited value.

RECOMMENDATIONS

It is recommended that Research Project No. 6 be terminated.

Idaho's specification of a maximum alkali content in cement of 0.6% should be continued.

REFERENCES

1. Lea, F. M., The Chemistry of Cement and Concrete, St. Martin's Press, 1956, pp. 493-498.

2. Oglesby, D. H., and Hewes, L. I., Highway Engineering, John Wiley & Sons, 1966, pp. 678-679.

APPENDIX

CEMENT - AGGREGATE INVESTIGATION

Mix: By Weight

1 - Cement
2 - Fine Aggregate
- Water
- Admixture

Materials:

Cement See Chart
Aggregate "K" J-2
3 miles E. Roberts
Jefferson County
Admixture